

REMARKS

The Final Official Action mailed June 9, 2009, and the Advisory Action mailed September 28, 2009, have been received and their contents carefully noted. Filed concurrently herewith is a *Request for Two Month Extension of Time*, which extends the shortened statutory period for response to November 9, 2009. Also, filed concurrently herewith is a *Request for Continued Examination*. Accordingly, the Applicant respectfully submits that this response is being timely filed.

The Applicant appreciates Examiner Wilson's time in conducting a personal interview on October 22, 2009. As described in more detail below, the Applicant presented examples of advantages that are achieved by the present invention. The Examiner agreed to consider the Applicant's remarks following the submission of this *Amendment*.

The Applicant notes with appreciation the consideration of the Information Disclosure Statements filed on July 27, 2006, and September 21, 2006.

A further Information Disclosure Statement is submitted herewith and consideration of this Information Disclosure Statement is respectfully requested.

Claims 1-9 and 11-26 were pending in the present application prior to the above amendment. Claims 1-9, 13-16, 20 and 21 have been amended to better recite the features of the present invention; claims 11, 12 and 22-24 have been canceled without prejudice or disclaimer; and new claims 27-29 have been added to recite additional protection to which the Applicant is entitled. Accordingly, claims 1-9, 13-21 and 25-29 are now pending in the present application, of which claims 1-4, 8, 9, 13-16, 20 and 21 are independent. For the reasons set forth in detail below, all claims are believed to be in condition for allowance. Favorable reconsideration is requested.

Initially, it is noted that in response to a suggestion by the Examiner raised during the personal interview, the Applicant has amended the paragraph beginning at page 44, line 25 (paragraph [0151] as filed) to correct a minor informality regarding the descriptions of Figures 13 and 14.

Paragraph 5 of the Official Action rejects claims 1-3, 5, 6, 8, 9, 11-15, 17, 18 and 20-26 as obvious based on the combination of U.S. Publication No. 2003/0218418 to Sato and U.S. Patent No. 6,084,176 to Shiratsuchi. Paragraph 6 of the Official Action rejects claims 1, 4, 7-9, 11-13, 16, 19-21 and 23-26 as obvious based on the combination of Sato and U.S. Patent No. 5,487,953 to Shirota. The Applicant respectfully submits that a *prima facie* case of obviousness cannot be maintained against the independent claims of the present application, as amended.

As stated in MPEP §§ 2142-2144.04, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some reason, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some reason to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The prior art, either alone or in combination, does not teach or suggest all the features of the independent claims, as amended. In order to address concerns raised by the Examiner during the personal interview, independent claims 1-4, 8 and 9 have been amended so as to replace "composite material" with "composition for manufacturing a light emitting element" and "an inorganic compound" with "one of vanadium oxide, tantalum oxide, molybdenum oxide, tungsten oxide, rhenium oxide,

and ruthenium oxide.” Independent claims 13-16, 20 and 21 have been amended so as to replace “an inorganic compound” or “an oxide of a transition metal” with “one of vanadium oxide, tantalum oxide, molybdenum oxide, tungsten oxide, rhenium oxide, and ruthenium oxide.”

During the personal interview, the Examiner raised a concern that the advantages of the present invention are achieved in a device not just the composition. In response, the Applicant has amended independent claims 1-4, 8 and 9 to recite a “composition for manufacturing a light emitting element.” The other independent claims are already directed to a “light emitting element.”

For the reasons provided below, Sato and Shiratsuchi or Shirota, either alone or in combination, do not teach or suggest the above-referenced features of the present invention.

All the claims of the present application are rejected as obvious based in part on Sato. The Official Action asserts that it would have been obvious to add metal oxides from the anode buffer layer (3 in Figure 3) to the hole transporting layer (4 in Figure 3) since they share some similar properties (small ionization potential, high hole mobility, and excellent stability). The Official Action asserts that “Sato et al. teach that vanadium oxide, ruthenium oxide, and molybdenum oxide ... meet the requirements of a suitable hole transporting material ...” (page 2, Paper No. 20090916) and cites advantages related to an anode buffer layer as justification to incorporate the material of the anode buffer layer into the HTL. The Applicant respectfully disagrees and traverses the assertions in the Official Action.

Simply because the material of the anode buffer layer (metal oxide) and the HTL (organic complex) share some similar properties, they do not share all properties. A showing of some similar properties is insufficient to show that the materials are interchangeable, particularly here where the materials are significantly different.

Chemical arts are inherently unpredictable. Against this tenet, it is not at all clear that combining the anode buffer layer and the HTL, which are disclosed in Sato as separate and distinct elements, would have a reasonable expectation of success.

In fact, taking the assertions in the Official Action on their face that the disclosed metal oxides of the anode buffer layer "meet the requirements of a suitable hole transporting material" would suggest to one of ordinary skill to merely replace the HTL with the anode buffer material. However, such a modification would destroy the functionality of the device since the resulting layer would require a thickness that would allow for sufficient carrier recombination to emit light. Therefore, the materials and layers disclosed in Sato are critical to the functioning of the Sato device, which is contrary to the modifications proposed in the Official Action.

One of the features of the present invention is that an effect of absorption in the visible wavelength region is small as shown in paragraph [0082] of the present specification. The Applicant respectfully submits that the metal oxides recited in the present amended claims are consistent with the features discussed above relating to the situation when the metal oxides are mixed with the organic compound of the claims. Even if the claimed metal oxides themselves absorb light in the visible wavelength region, the color can be ignored in the form of the composition of the organic material and the metal oxides. In order to more clearly recite the absorption features and advantages of the present invention, the Applicant has amended the claims to recite "one of vanadium oxide, tantalum oxide, molybdenum oxide, tungsten oxide, rhenium oxide, and ruthenium oxide."

During the personal interview of October 22, 2009, the Applicant's representative explained that the present invention is directed to a composite material that includes an organic compound (formula 1, for example) and an inorganic compound that is an oxide of a transition metal. This combination of an inorganic oxide of a transition metal and an organic compound in a single layer is advantageous over two (organic/inorganic) layers.

First, an organic compound layer has high resistivity if formed in a relatively thick layer and can short circuit if formed in a relatively thin layer. Therefore, the thickness is not flexible and must be strictly controlled.

Second, an inorganic layer has relatively great conductivity and can lead to short circuits. It is also easily crystallized, which leads to greater conductivity and thus is more likely to short circuit. Therefore, again, thickness is not flexible. In this regard, holes can be lost if the conductivity is too great as they move past the light emitting layer and recombine outside that layer.

Third, when an interface of the organic/inorganic layers is created, an energy barrier is created and the mobility of carriers is impacted. Also, physical damage results at the barrier and the lifetime of the device is adversely impacted.

In a mixed layer as claimed in the subject application, the film thickness is flexible and the conductivity can be precisely controlled. This is shown in Figure 10 of U.S. Publication No. 2007/0200125 to Ikeda (by the same Assignee), for example. Similarly, in the present application, a composition of molybdenum oxide and CzPA is disclosed in Embodiment 4 instead of a composition of molybdenum oxide, DNTPD (4,4-bis(N-(4-(N,N-di-m-trylamino)phenyl)-N-phenylamino)9biphenyl) and rubrene as disclosed in U.S. Publication No. 2007/0200125 to Ikeda. The difference between the four elements is the thickness of the composition layer of a composition of molybdenum oxide, DNTPD and rubrene, i.e., 40 nm (closed circles), 80 nm (open circles), 120 nm (closed squares), and 160 nm (open squares). The Applicant respectfully submits that one of ordinary skill in the art at the time of the present invention would understand that a voltage-luminance curve is constant or nearly constant and generally does not depend on a thickness of the composition layer, which is CzPA and molybdenum oxide in Embodiment 4.

Also, paragraph [0082] of the present publication describes a similar result in that as the thickness of the layer increases, the onset voltage remains substantially the

same. As a result, an optical path length of the light emitting element can be controlled by varying the layer thickness and external coupling efficiency is improved.

Further, since there is no energy barrier formed, less deterioration of the device and longer lifetimes can be realized.

Finally, in the subject application, the claimed formula (carbazole)/oxide combination is particularly advantageous in that it does not absorb light and therefore color purity of light emitted from the device can be maintained and accurately controlled. This is seen in Figure 12 of the pre-grant publication ('611) of the present application, wherein it can be seen that the absorption in the visible spectrum is less for the combined material than for the organic material alone.

The Applicant respectfully submits that Sato and Shiratsuchi or Shirota, either alone or in combination, do not teach or suggest the above-referenced features and advantages of the present invention.

Since Sato and Shiratsuchi or Shirota do not teach or suggest all the claim limitations, a *prima facie* case of obviousness cannot be maintained. Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) are in order and respectfully requested.

New claim 27-29 have been added to recite additional protection to which the Applicant is entitled.

Claim 27 has been added and recites "wherein a thickness of the layer including the organic compound represented in the general formula (1), and one of vanadium oxide, tantalum oxide, molybdenum oxide, tungsten oxide, rhenium oxide, and ruthenium oxide is 60 nm or more" (emphasis added).

In order to further define features of the present invention, claim 28 recites "wherein the organic compound represented in the general formula (1), and one of vanadium oxide, tantalum oxide, molybdenum oxide, tungsten oxide, rhenium oxide, and ruthenium oxide is in contact with the first electrode" (emphasis added). With respect to claim 13, from which claim 28 depends, to the extent that the Examiner

believes that two discrete layers in the prior art would inherently disclose the claimed composition, the Applicant respectfully submits that such prior art is non-enabling with respect to the claimed composition, and the claimed composition would not be inherent or obvious in view of any such prior art.


Regarding claim 29, during the interview, the Examiner suggested the possibility of claiming a specific percentage of organic to inorganic material. In response, claim 29 has been added, which recites "wherein mixing ratio of the organic compound and the one of vanadium oxide, tantalum oxide, molybdenum oxide, tungsten oxide, rhenium oxide, and ruthenium oxide is 1:0.1 to 1:10 in molar ratio" (emphasis added), which is supported in the present specification, for example, by paragraph [0044] of the pre-grant publication ('611) of the present application.

For at least the reasons stated above and already of record, the Applicant respectfully submits that new dependent claims 27-29 are in condition for allowance.

Should the Examiner believe that anything further would be desirable to place this application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized to charge fees under 37 C.F.R. §§ 1.16, 1.17, 1.20(a), 1.20(b), 1.20(c), and 1.20(d) (except the Issue Fee) which may be required now or hereafter, or credit any overpayment to Deposit Account No. 50-2280.

Respectfully submitted,



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